I. INTRODUCTION

1.1 Background

Singgalang cabbage (*Brassica oleracea* L. var. *capitata*) belongs to the Brassicaceae family. It is a local vegetable cultivated in the slope area of Mount Singgalang, Agam regency, West Sumatra. This plant is one of the vegetables that has been exported to Singapore (Marimbo, 2004). In general, the production of cabbage in 2018 was around 1.41 million tons, which decreased when compared to the previous year (Central Bureau of Statistics, 2018). These might be happened due to a long period of cultivation, lack of nutrient supplies, and decreasement of area for cultivation. One of the solutions to overcome this problem is using hydroponic.

Hydroponic is one of the applicable technologies in agriculture which can solve the growing of vegetables under limited areas (Roidah, 2014). In hydroponic, there are several systems used to deliver nutrients into plants, the simplest one is the wick system. Plants will grow optimally under adequate nutrition in this system. The AB-MIX (commercial fertilizer) is commonly used in hydroponic for that purpose. Harahap *et al*., (2020) confirmed that the AB-MIX is able to provide sufficient nutrition for the growth and production of pak choi (*Brassica chinensis* L.) under the wick system. However, the use of AB-MIX is considered to be a weakness in hydroponic because it is an inorganic fertilizer with a fairly high price. The solution to reducing the use of inorganic fertilizers is by substituting using liquid biofertilizer.

Liquid biofertilizer is an alternative source of nutrient solution. It has several benefits *e.g.*, easy to use, availability of microorganism population, require minimum dose for application, cost-effective, very high enzymatic activity, and environmentally friendly (Hoe and Rahim, 2010; Chopra and Mali, 2020). Phibunwatthanawong and Riddech (2019), explained that liquid biofertilizer derived from sugarcane leaves and distillery slop gave the best results in the growth of green cos lettuce under hydroponic. This result was almost similar to inorganic fertilizers. Liquid biofertilizer can be produced with the fermentation of composted organic materials by biological agents (Pergola *et al*., 2018; Yani, 2018). The black soldier fly larvae (BSFL) is one of biological agents which uses organic material as a source for their food and turn it into compost known as maggot frass (Klamssteiner *et al*., 2020). The production of liquid biofertilizer can be done with commercial bio activators *i.e.*, effective microorganism 4 (EM-4) (Riry, Rehatta and Tanasale, 2013). Pakpahan *et al*. (2020), explained that the combination of BSFL liquid biofertilizer and 50% of NPK fertilizer provide great results as equivalent to 100% of NPK on the growth of sugarcane. Research by Nurhuda (2021), showed that the combination of EM-4 and manure organic fertilizer improves the growth of shallot.

The use of liquid biofertilizer from maggot frass has not received good attention. One of the problems is the different nutritional content caused by various food sources fed to the maggots. To standardize nutritional content on maggot frass, it can be done by controlling food intake. Kirinyuh (*Chromolaena odorata*) is one of the potential food sources for BSFL. Based on the research by Sanjaya, Suhara and Halimah (2020), 150g of BSFL is able to convert 80-100% of kirinyuh leaves

into maggot frass. Recently, Adilla (2021) explained that liquid biofertilizer produced from kirinyuh leaves with a concentration of 60% was able to increase the growth parameters of mustard pakcoy.

Based on the explanation above, research conducted entitled "Liquid Biofertilizer from Fermented Kirinyuh Maggot Frass as Inorganic Fertilizer Substitute for the Growth of Singgalang Cabbage in Hydroponic System". This research mainly aimed to substitute inorganic fertilizers used in hydroponic with liquid biofertilizer from kirinyuh maggot frass (here after written as LBFKMF) in improving the growth of singgalang cabbage.

1.2 Formulation of Research Problems

The formulation of research problems that want to be answered are as follows:

1. Is LBFKMF able to substitute the use of AB Mix in improving the growth of singgalang cabbage hydroponically?
2. In which concentration of LBFKMF that has the best result to substitute the use of AB Mix in improving the growth of singgalang cabbage hydroponically?
3. How is the growth of singgalang cabbage on hydroponic media which is substituted with LBFKMF?
4. Is there any symptoms of deficiency or toxicity in the use of LBFKMF for the growth of singgalang cabbage hydroponically?

1.3 Research Objectives

The purposes of the research are:

1. To find out that the LBFKMF is able to substitute the use of AB Mix in improving the growth of singgalang cabbage hydroponically.
2. To find out the best concentration of LBFKMF in improving the growth of singgalang cabbage hydroponically.
3. To observe the growth of singgalang cabbage on hydroponic media which is substituted with LBFKMF.
4. To observe any symptoms of deficiency or toxicity in the use of LBFKMF for the growth of singgalang cabbage hydroponically.

1.4 Research Benefits

In general, this research is expected to be a reference in the cultivation of singgalang cabbage by using liquid biofertilizer as a substitute compound in organic farming hydroponically. Moreover, it can be used as basic information for developing of singgalang cabbage in limited areas using a hydroponic system (urban farming technologies).